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Fundamental Factors in Infant Mortality

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INFANT mortality has come to mean infinitely more than the deaths of so many babies under one year of age. It is true that the infant mortality rate is most conveniently expressed as the number of deaths under one year of age per one thousand live births during the year under consideration, but its factors are diverse and permeate the basic strata of our social structure. Infant mortality must now be looked upon as a socio-economic complex whose finer ramifications can be traced to hereditary, congenital, neonatal and environmental roots. It reveals not only the sanitary status of a community, but its social, economic and moral aspects as well. It has, therefore, to be regarded as the most sensitive index we have of social and sanitary progress. Its marked reduction during the past decade is one of the outstanding phenomena of the new public health movement and a prime factor in lowering the general death rate.

INFANT MORTALITY CONTROLLABLE

From the humanitarian standpoint, the study and prevention of infant mortality has drawn the attention of philanthropic individuals for many years. It is only since the opening of the twentieth century, however, that a scientific study of the causes and results of infant mortality has been made and the findings applied to public health. The experience gained thus far in practical methods of community sanitation and infant hygiene has brought home convincing proof that the main factors entering into the mor-

talities of infancy can largely be controlled and the infant mortality rate considerably reduced. We can no longer defend ourselves behind the mediaeval fallacy that God sets the infant mortality rate.

In giving consideration to the fundamental factors which enter into the mortalities of infancy we soon discover that a number of the unfavorable conditions which determine a high infant mortality are also detrimental to life at all ages, although acting with diminishing force as age advances. Improvements in sanitation and hygiene, better social and economic circumstances and more intelligent understanding of mothers in the care of their babies, have had a decided effect in creating more wholesome conditions under which the older children may be reared. Future offspring are thus assured a better chance of surviving. Thus infant mortality is at once a reflection upon the past and a prophecy of the future.

INFANT MORTALITY AND PRE-SCHOOL YEARS

In seeking to prevent infant mortality we are laying the foundation for a healthier and more resistant childhood. Our statistical studies have progressed far enough to indicate that there is a high correlation between infant mortality and of mortality at ages from one to five years. It has been shown by Sir Arthur Newsholme in England and by Dr. S. Josephine Baker in New York City, that a high infant mortality rate goes hand in hand with a high death rate at ages one to five, and, conversely,

that when the infant mortality rate is reduced the rate at higher ages also comes down.

We must not overlook the additional fact that an excessive infant mortality predisposes those who survive to more damage than is the case with a low mortality. While it is recognized that the mortality in the years following infancy is surprisingly low, it is not so generally realized that the damage rate during those years is exceedingly high. In the pre-school period the child acquires most of the defects which are discovered later at school, and from which he suffers more or less throughout his entire life. The paramount importance of the pre-school years in determining the health-destiny of the child is just beginning to be recognized, and for these we must make as ample provisions as we have for the baby in arms.

REDUCTION OF MORTALITY DURING FIRST YEAR

The reduction of infant mortality thus far effected has taken place largely in the latter half of the first year of life. This has been brought about mainly by a reduction of the deaths from gastro-intestinal diseases, the result of greater insistence upon breast feeding, better milk and more intelligent modification of milk under the direction of physicians, and supervision and instruction of the nurses in the homes. Infant welfare centers and general campaigns of education have also played a large part.

NEONATAL DEATHS PREVENTABLE

With all this intensive effort in infant hygiene, very little if any progress has been made, outside of a few centers where special prenatal work has been carried on, in limiting deaths in the neonatal period. In this country upwards of 40 per cent of the deaths during the first year of life occur in the

first month. In some places it reaches as high as 50 per cent and above. It is conservatively estimated that 40 per cent of the neonatal deaths could have been prevented by proper prenatal and obstetrical care. The intensive prenatal services which have been organized in New York City, Boston and other cities in this country give promise of what we may hope to accomplish on a broader scale when the Federal Government and the states assume their full responsibility for the protection of maternity and infancy.

MATERNAL MORTALITY SHOCKING

The maternal mortality in this country is still shockingly high, and has been advancing to an alarming extent in recent years. The maternal mortality rates in the United States are uniformly higher than those in a number of foreign countries. This evidently is one of the factors which must be considered in any infant mortality study. The number of stillbirths and abortions, accidental and induced, are also abnormally high. While general sanitation and infant hygiene have had a marked effect in reducing infant mortality in the sixth, seventh and eighth months of life, they have scarcely made a dent upon the birth mortalities and apparently have not influenced in the least the number of stillbirths and abortions. For any further considerable reduction in infant mortality we must look to well organized prenatal and obstetrical service made available to every mother. In this the Federal Government and the states must coöperate with the local health authorities and voluntary organizations.

VARIABILITY OF INFANT MORTALITY

The most outstanding feature of infant mortality is its variability. It exhibits marked geographical, social, racial and seasonal fluctuations. The

infant mortality rate not only differs markedly throughout the same country, but in neighboring cities and even adjacent wards of the same city. From month to month it shows interesting variations, and year after year may exhibit changes which are difficult to explain.

To gain any fair estimate of the trend of infant mortality, then, we must study it under varying conditions over a series of years. The factors entering into it are so complex and interdependent that no one formula can be applied for its complete solution. Each factor must be separately weighed and its proper relation to others determined. From such study intensive methods may be evolved to reduce the mortality factor by factor until the lowest possible denominator is reached. At the same time we should never lose sight of the fact that infant hygiene is an integral part of preventive medicine. General public health measures may have considerable bearing upon the reduction of infant mortality.

DIRECT CAUSES OF INFANT MORTALITY

In considering the fundamental factors in infant mortality it will be convenient to think of them as both direct and contributing. In this brief summary it will not be possible to go into a statistical study of these factors to show their exact or relative importance. They will, therefore, be given in a broad classification only.

The direct causes of infant mortality may be grouped as follows:

Prenatal, Natal, and Neonatal.

Congenital defects. Malformations.

Congenital diseases (infectious diseases acquired from the mother, syphilis being the most important).

Prematurity (often due to congenital syphilis).

Indefinite causes listed as "atrophy," "congenital debility," "marasmus"

and "inanition," very often due to syphilis.

Atelectasis, Asphyxia ("cyanosis").

Diseases of the mother. Diseases of the heart, kidneys or lungs; the acute infectious diseases. Alcoholism, lead poisoning and malaria. The toxæmias of pregnancy resulting in eclampsia may cause premature death of the foetus.

Injuries at birth.

Gastro-Intestinal Diseases.

Diarrhoea and enteritis.

Diseases of the stomach.

Dysentery.

"Convulsions" are often one of the symptoms of gastro-intestinal disturbance. They may also be due to head injuries at birth. In the latter months of infancy convulsions may suggest a tuberculous meningitis. Convulsions may also usher in one of the acute infectious diseases of infancy and childhood.

Respiratory Diseases.

Pneumonia, broncho- or lobar.

Bronchitis.

These may be primary, but are frequently secondary to the acute infectious diseases as measles, whooping-cough, influenza, etc.

Infectious Diseases.

Syphilis (usually congenital).

Tuberculosis, generalized or tuberculous meningitis, usually acquired in the home environment; sometimes from tuberculous cow's milk.

Whooping-cough. Serious in early infancy with unfavorable sequelae.

Measles. Serious in infancy. Highest death rate from measles occurs in second year of life.

Influenza. During epidemics may be an important cause of death.

Scarlet fever (rarely a cause of death in infancy).

Diphtheria. High immunity in early infancy.

The prenatal and neonatal factors bulk largest in our present infant mortalities. The problems of ante-natal and neonatal pathology are beset with many difficulties, but an excellent be-

ginning in their solution has been made by Ballantyne and his co-workers. It is of great importance to realize that the welfare of the mother has both a direct and an indirect bearing upon the health of her unborn child. Prenatal care is synonymous with maternity welfare. The nutrition of the mother is reflected in the nutrition and growth of the foetus. The quality of the food even more than its quantity has been shown to have a marked influence on the unborn infant. Infectious diseases, notably syphilis, have a prejudicial effect upon the foetus.

The employment of the mother in the latter months of pregnancy in industry which calls for considerable exertion affects unfavorably the outcome for the child. Hence, steps have been taken in most of the European countries to throw about pregnant women in industry certain safeguards and to make provisions for them both before and after confinement. The tendency in those countries has been to extend maternity benefits in medical and nursing service and to make more ample provisions for the mother during the time she is out of work.

CONDITION OF THE MOTHER AND PRENATAL CARE

The nationality of the mother, her age, the number of her previous pregnancies, her social and economic status—all have more or less of a bearing upon the outcome of her pregnancy and the welfare of her baby. Illegitimacy has a decided influence upon the infant mortality, the rate being about twice as high as that for legitimate babies. The underlying causes of congenital defects and malformations are but little understood. These, however, form a small proportion of the deaths from prenatal causes. Over-work and exhaustion or injury to the mother, appear in a certain number of cases to

have brought on premature births and miscarriages. We are much in the dark as to the cause of many of the stillbirths. It is known that syphilis is the most prolific cause, and that over-work and strain are often contributing factors.

Summing up our present knowledge as it bears upon the prevention of ante-natal mortality, it is fair to assume that between 40 and 50 per cent of the early deaths can be prevented by intensive prenatal care. Other factors will undoubtedly yield to treatment as our investigations become more exact. The intensive and thorough treatment of syphilis in pregnant women bids fair to reduce considerably the number of ante-natal deaths and to affect favorably the infant mortality rate among those who survive.

BUNGLING OBSTETRICS

The number of infants who perish at the time of birth or shortly thereafter, reflects seriously upon the present state of our midwifery. Too little attention is still given by our physicians and midwives to that prenatal care which assures a safe and happy outcome to pregnancy. The science of obstetrics has risen to almost an exact science comparable to that of mechanics, but its practice as carried on by the ordinary practitioner of medicine and the ignorant midwife is far from ideal. If the true causes of death of newborn infants were recorded on the death certificates it is probable that a high percentage of them could be traced to either lack of suitable prenatal care or to bungling obstetrics, or to both. The high maternal mortality rate in this country indicates that the mothers do not even receive all the care which our knowledge prompts. Are not the pages of Semmelweis and Holmes, of Pasteur and Lister open before us?

BIRTH CONTROL

While we face the appalling loss of life *in utero* or shortly after birth, we are confronted with another social malady which insidiously invites erotic stimulation but refuses to bear the responsibility, which should normally follow, of rearing offspring. Studies on depopulation in various countries have forced the conclusion that the decline in the birth rate, while having social and economic roots, is still largely due to voluntary limitation of the offspring either by means of contraceptive measures or abortion, if conception has "accidentally" taken place. Throughout the civilized world there is an ever widening propaganda for so-called "birth control" or "voluntary parenthood." Special periodicals are devoted to its cult and sold on the streets of our metropolitan centers. The movement has gained momentum in France, Holland and New Zealand and has spread in England and the United States.

Thus far the contraceptive methods advised have been practised largely by the upper social classes and those in good economic circumstances. Those most able to bear children and to meet the expense of their upbringing have been the very ones to shirk the responsibility while those for whom "birth control" is claimed to be a great boon still continue to "breed like rabbits." It is questionable, even if "birth control" should accomplish all that its devotees claim, whether any considerable proportion of the population would take all the necessary precautions under the urge of the "race preservation instinct." There is no question at the present time that the native American stocks are rapidly dying out as a result of their declining fertility and are being replaced by races or mixtures of races which do not refuse to bear chil-

dren. Take, for instance, the rise of the Russian and Polish Jews on the Atlantic coast and the Japanese and Italians on the Pacific slope.

THE DECLINING BIRTH RATE

It is instructive here to recall that the declining birth rate in France gave alarm as early as 1870 and led to a thorough study of the causes of infant mortality and their prevention. The intensive methods employed in France for child hygiene give her the distinction of being the pioneer in modern maternity and infant welfare. Despite this, France today faces an even more serious situation than she did after the Franco-Prussian War as the undercurrents of "birth control" have formed eddies in a number of centers which prevent that healthy recuperation assured by a substantial increase of births. Germany also realized that motherhood should be protected and births encouraged. Before the War, Germany had set up well conceived measures for the protection of maternity and infancy. Special attention was given to maternity benefits. Every effort was made to keep babies with their mothers, and nursing benefits were supplied.

In England is witnessed the interesting phenomenon of a gradually increasing birth rate with an infant mortality rate which continues to fall, reaching the low figure of 80 in 1920. While it cannot be shown that there is an invariable relation between the birth rate and infant mortality, it is within bounds to say that no country with a declining birth rate can ultimately maintain itself unless definite steps are taken to reduce the infant mortality to its lowest limits. It is even then questionable whether the "stranger within the gates," who has carried out the Biblical mandate to

"be fruitful and multiply," will not eventually possess the land.

COMPLEXITY OF CONTRIBUTING FACTORS

The direct causes of infant mortality have already been listed. They may be followed in detail by consulting some of the books given as references at the end of this brief discussion. The principal causes, while acting as guides to our knowledge of infant mortality, do not carry us very far into the contributing factors. To gain some idea of the complexity and diversity of these contributing causes the most important of them are here given, although no attempt is made to assign their relative importance or mutual relationship:

CONTRIBUTING FACTORS INFLUENCING INFANT MORTALITY

Character of the Population.

- Racial stamina and resistance.
- Habits and customs.
- General intelligence.
- Age distribution.
- Homogeneity.
- Diversity of language.
- Industrial welfare.
- Stability of residence.

Meteorological.

- Variations in temperature.
- Relative humidity.
- Prevailing winds. Dust storms.
- Sunshine or fogs.

Births.

- Marked increase or decrease in birth rate.
- Changes in completeness of birth notification and registration.
- Relative number of first born in any one year.
- Proportion of male to female.
- Proportion of legitimate to illegitimate births.
- Number of stillbirths.
- Attendants at birth.

Nationality.

- Manners and customs.
- Prevalence of breast feeding.

- Immunity to certain diseases.
- Adaptability to new environment.
- White *vs.* Negro death rates.

Condition of the Mother.

- Poverty and bad social life.
- Shiftlessness and ignorance.
- Industrial employment.
- Age at marriage.
- Frequency of pregnancies.
- Urban or rural life.
- Malnutrition.
- Exhausting diseases (Tuberculosis and syphilis).
- Alcoholism.
- Industrial poisonings.

Standards of Public Health.

- Milk and water supplies.
- Domestic and municipal sanitation.
- Character of prenatal and obstetric care.
- Housing conditions.
- Training of physicians and nurses in infant welfare.
- Organization of infant welfare.
- Methods of infant feeding. (Proportion of breast feeding.)
- Provisions for treatment of syphilis and tuberculosis.
- Prevalence of vaccination.
- Supervision of midwives.
- Organization for handling epidemics.

Social and Economic Conditions. Wars and Their Aftermath.

- Unemployment.
- Food shortage.

SUMMARY

So many factors are seen to contribute to the mortalities of infancy that no general statement can be given to cover the whole subject. The most logical way to attack the problems which arise in connection with infant mortality is to study each factor thoroughly and apply intensively to each the medical, social and economic resources at our command. This method has resulted in a marked reduction of infant deaths from the gastro-intestinal diseases; it has made inroads upon the respiratory diseases and some of

the acute infections. It remains to be extended to prenatal, natal and neonatal causes of death and to the final conquest of syphilis and tuberculosis.

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Community Measures to Conserve Child Life

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IT is by "painful steps and slow" that organized society has found its way to even the present inadequate sense of social responsibility.

Tremendous social upheavals, threatening the very foundations of society itself, have, as a rule, been the compelling forces which have marked

forward steps. Stated otherwise, society has advanced in the handling of the problems of special groups or has elevated the required standards of welfare for such groups only in response to a selfish impulse for self-preservation.

With a certain amount of complaisance, modern society has come to look